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Potential impacts of classifying specific strains of *Salmonella* with multi-drug resistance as adulterants in ground beef and poultry products

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Brief reviewed by a multidisciplinary, multi-sector team of experts.

Summary of Findings:

- The US Centers for Disease Control (CDC) considers strains of *Salmonella* resistant to multiple antibiotics (multi-drug resistant or MDR *Salmonella*) to be serious public health concerns, leading to proposals to declare them to be adulterants in ground beef and poultry.
- While testing has shown progress, current technology cannot assure that all raw meat and poultry are *Salmonella*-free.
- Available methods to detect and confirm MDR *Salmonella* are not practical to support regulatory intervention on the scale that would be required by the proposed policy.
- Declaring MDR *Salmonella* an adulterant in ground beef and poultry would likely have greater costs and fewer public health benefits in comparison to when *E. coli* O157:H7 was declared an adulterant.
- Additional analyses are needed to identify more effective public health interventions to address MDR *Salmonella*

Background

The percent of positive *Salmonella* tests for young chickens in the PR/HACCP verification testing program decreased from an original baseline of 20% in 1995 to 3.9% in 2013[1]. However, a high proportion of *Salmonella* Heidelberg, *S.* Newport, and *S.* Typhimurium isolated from retail meat and poultry products are resistant to multiple types of antibiotics used to treat human illnesses (multi-drug resistant or MDR *Salmonella*). The proportion of MDR *S.* Newport and *S.* Typhimurium isolated from humans has been decreasing over the past decade, from 25% to 5 % for *S.* Newport and from 41% to 29% for *S.* Typhimurium, MDR, but *S.* Heidelberg rates continue to increase, peaking at 44% in 2011, the most recent year available[2,3]. The Centers for Disease Control and Prevention (CDC) consider drug-resistant *Salmonella* as a serious threat that "requires prompt and sustained action to ensure the problem does not grow"[4]. In response, several proposals have been made to declare specific strains of MDR *Salmonella* in ground meat and poultry products to be adulterants[5,6].

Current legal status of *Salmonella* in foods

Meat and poultry products are regulated by the United States Department of Agriculture, Food Safety and Inspection Service (FSIS). A meat or poultry product can be considered adulterated if it "contains any poisonous or deleterious substance which may render it injurious to health; but in case the substance is not an added substance, such article shall not be considered adulterated under this clause if the quantity of such substance in or on such article does not ordinarily render it injurious to health"[7,8]. While *Salmonella* is not considered to be an added substance, and thus currently is not legally considered an adulterant, FSIS has declared some other non-added substances, like *E. coli* O157:H7 in 1996, to be adulterants because they can render ground beef products injurious to health.

Relevance of *E. coli* O157:H7 in ground beef model

Declaring *E. coli* O157:H7 an adulterant in ground beef[9,10], together with the concerted efforts of multiple food industry segments, regulatory, and public health officials, led to a drop in the incidence of *E. coli* O157:H7 infections from 2.6 cases per 100,000 population in 1996 to 1.1 cases per 100,000 in 2012[9]. This strategy was successful because cattle are the

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primary food animal reservoir for *E. coli* O157:H7, interventions could be developed to prevent surface contamination of meat tissues at slaughter, and relatively rapid, sensitive, and specific screening tests were developed to detect the presence of *E. coli* O157:H7. However, MDR *Salmonella* presents more complicated challenges. Unlike *E. coli* O157:H7, MDR *Salmonella* occur in multiple food animal species, the organisms may spread through internal tissues, and MDR *Salmonella* requires extensive testing to be distinguished from other, sensitive strains of *Salmonella*.

Technical challenges in testing for MDR *Salmonella*

Identifying the presence of specific MDR strains of *Salmonella* requires a multi-stage process requiring a week or longer to confirm. While meat and poultry processors employed a test and hold technique with *E. coli* O157:H7, this approach is not practical due to the number of products requiring holding and the length of time necessary to get test results for MDR *Salmonella*.

Potential impact of 'adulterant' policy on number and scope of recalls

Between 2006 and 2013, seven *Salmonella* outbreaks linked to ground beef or poultry products led to recalls. Product testing not linked to human illness would lead to many more potential recalls if MDR strains of *Salmonella* were considered adulterants. For example, limited FSIS pathogen reduction/Hazard Analysis Critical Control Point (HACCP) verification testing found MDR *Salmonella* in one additional ground beef, 81 additional ground turkey, and 71 additional chicken samples in 2011 alone[2,11]. Thus, implementation of the adulterant policy would increase dramatically the number of these products that would be subject to regulatory action.

Potential impacts on stakeholders

Processors would have to hold product that was tested, pending test results. If tested product was allowed in commerce prior to results, then distributors and retailers would have to secure and destroy existing product or attempt to recover product from customers if products in commerce found to be contaminated. Federal, state, and local regulatory and public health agencies would need to provide oversight for recall efforts, respond to public inquiries, and investigate potential illnesses. Costs of increased product loss would need to be recovered by increasing prices for consumers. Publicity about the recalls could reduce consumer demand for specific products that could have long term implications for processors and farmers.

Potential opportunities and limitations of alternative control strategies

Current technology cannot assure that all raw meat and poultry are *Salmonella*-free. While vaccines have been developed to control specific strains of *Salmonella* in poultry, their use in the absence of an effective universal vaccine may open up ecological niches for other, potentially more virulent *Salmonella* strains. Irradiation could be used for the control of *Salmonella* in ground meat and poultry products but its application to date has been limited by resistance from some consumer organizations and lack of consumer demand. Other pathogen reduction treatments such as high-pressure treatment may be more acceptable alternatives. Although cooking can destroy pathogen infectivity, consumer groups appear unwilling to focus prevention messages directly at consumers.

Framework for considering the balance of likely outcomes of the policy

From a public health standpoint, good policies have greater expected benefits in reducing the burden of foodborne illness than negative consequences. Current scientific evidence and available testing technology demonstrate that declaring MDR *Salmonella* an adulterant would have greater costs than benefit. Additional analyses are needed to identify more effective public health interventions.

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